SECTION 02732
WASTEWATER PUMPING STATIONS

PART 1 -- GENERAL

1.1 SECTION DESCRIPTION

A. This section includes materials and installation standards, and Contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to install, complete and make ready for operation all wastewater pumping stations as shown on the Drawings and as specified herein. This section also includes the modifications to existing pumping stations.

1.2 SUBMITTALS

A. A minimum of three (3) sets of shop drawings shall be submitted to SLCU and Engineer of Record for approval.

B. Shop drawings will include information on wet well, valve pit, pumps, valves, guide rail systems, pressure gauges, access covers, control panel, electrical schematics and any other requirements necessary to complete the lift station installation.

C. Data shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorages, and support required; and dimensions needed for installation and correlation with other materials and equipment. All part numbers and catalog data required for ordering spares and replacements shall be provided.

D. The acceptance of drawings returned marked "ACCEPTED" or "ACCEPTED AS NOTED" will not constitute a blanket approval of dimensions, quantities, and details of the materials, equipment, device or items shown and does not relieve the Contractor of any responsibility for errors or deviations from the requirements.

E. The submitted drawings and data shall be published by the manufacturer and shall include, but not limited to, the following:

1. Wet well and valve pit information

2. Mechanical equipment

3. Electric Motors

4. Controls and Wiring Diagram

5. Pump curves at listed RPM. Family curves are not acceptable.

F. Each pump shall be tested in the manufacturer's shop to demonstrate the proper operation of all components. The testing shall determine overheating of bearings, motors or other components.

1.3 QUALIFICATIONS

A. All equipment and materials shall be furnished by a manufacturer who is fully experienced, reputable and qualified in the manufacture of items to be installed/constructed.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Pumps, appurtenances and controls will be supplied by the same supplier. The use of stainless steel, minimum grade 316, nuts and bolts is required on all parts exposed to wastewater or hydrogen sulfide gases.

2.2 WET WELL

A. Type II Acid Resistant Portland cement conforming to ASTM C-150 shall be used for all built-in-place wet wells. Concrete for built-in-place and precast wet wells shall develop a minimum of 4000 psi at 28 days. Precast concrete wet wells shall conform to ASTM C-478 - Latest Revision, Class II, Wall B, Type II Portland Cement. Steel reinforcement shall conform to ASTM A-615 and ASTM A-185, Latest Revisions. Walls shall be 8-inch minimum. Joints shall be assembled with Ram-Neck Sealant or approved equal and overlaid with non-shrink, waterproof grout on the inside and outside of the wetwell.

B. The base slab and the first ring of the precast wet well shall be cast monolithically.

C. The interior of the wet well shall be provided with a protective semi-rigid fiberglass insert which shall protect all interior surfaces of the wetwell, including walls and underside of top section.

1. Certification must be submitted by the liner Manufacturer stating that:
   a. The intended liner use in domestic wastewater lift stations is a recommended application of its liner product.

2. Provide, with precast shop drawings, a letter stating Precast Fabricator will provide factory trained mechanic guidance to the Contractor during erection of the wet well.

3. Upon completion of construction, Contractor shall provide a certification from the Precast Fabricator stating that such dated field guidance was provided to the Contractor.

D. All exterior surfaces of the wet well and all piping surface inside the wet well shall receive two coats of an approved 100% solids coal tar epoxy in strict accordance with the manufacturer's instructions (i.e. concrete, grout, etc., shall be thoroughly cured, cleaned and dry). The first coat shall be red with the final coat being black and each shall be minimum 16 mils D.F.T. Interior coats shall be applied prior to pump installation.

E. Holes to accommodate pipe shall be precast into the section at the manufacturer's plant. Corrosion protection of holes shall be a 0.125-inch thick cementitious material, Fosroc Epoxy Liner or approved equal. The material shall overlap the wet well wall liner. Holes for anchor bolts and other attachments can be pre-formed or drilled. After installation the joint shall be sealed to the liner using butyl caulking materials, Lap Sealant FR 500 by A-Lock Products, or approved equal.

F. Any visible reinforcing wire, steel or honeycombs on precast structures shall be cause for rejection.

G. The wet well shall have a concrete top with a pad lockable diamond plate aluminum hatch cover (1/4" thick, minimum), with flush mounted pull up hasp, and frame with stainless steel hardware. Interior of wet well shall be fitted with stainless steel (316) upper guide bar brackets, cable holder, guiderails and grip eye lift cable. Aluminum hatch shall be capable of supporting a 300 lb. per square foot static load or H20 loading if in traffic areas. Each cover shall have a locking safety handle to retain the covers in an open position. Cover shall be sized and located to allow for unobstructed vertical removal of all pumps.

2.3 PIPING SYSTEMS

A. Piping within the wet well and valve vault shall be minimum 4" diameter flanged ductile iron pipe Class 52 with interior lining as specified.

2.4 VALVE VAULT

A. Valve vault (or pit) shall be precast concrete and cast as one integral structure with the bottom slab. The top slab may be cast independently. Dimensions, thickness and reinforcing shall be in accordance with the plans. Vault concrete shall be in accordance with Paragraph 2.2 A as stated previously. Valve Vault shall be adjacent to the wetwell.

B. Valve vault shall be equipped with an access frame complete with hinged and pad lockable, hasp-equipped covers of the size shown on the plans. Covers shall support a static load equal to 300 pounds per square foot or H20 loading if in traffic areas.

Frame shall be mounted securely in the top slab, aligned above the valves in the manner necessary to maximize free and unobstructed access to the valves for operation and maintenance. Each cover shall have a locking safety handle to retain the covers in an open position. Frame and cover shall be aluminum and all hardware to be 316 stainless steel.

C. Valve vault interior walls, pipes, valves, and fittings within the valve vault to be coated with coal tar epoxy as specified in 2.2D.

D. Check valves to include external spring and lever.

E. Shutoff valves to be resilient seated gate valves.

F. An emergency pump by-pass connection device shall be provided and shall include a male aluminum or bronze “Cam-loc” fitting with dust cap and isolation gate valve, installed downstream of the valve vault.

G. All fittings within valve vaults to have flange ends.

H. All hardware to be 316 stainless steel.

I. A four-inch drain with "P" trap shall be installed between the valve vault and the wet well.

J. Each discharge pipe shall be provided with a 4” diameter face pressure gauge, which shall be an oil-filled gauge. The gauges shall read in pounds per square inch and/or feet of water, with a range suitable for the required service and shall include isolation petcocks. Where the pressure source is wastewater, gauges shall be equipped with diaphragms (neoprene or stainless steel), or other suitable separating device, to preclude wastewater from entering the mechanism.

2.5 PUMPS

A. Pumps shall be non-clog, mechanical seal submersible pumps.

B. The pump electrical conductor shall be continuous multiconducter, copper cable (no splices), in compliance with industry standard for load and resistance against sewage. The conductor shall enter the pump through a heavy-duty entry assembly, which shall be provided with an internal grommet assembly to protect against leakage once secured and must have a strain relief assembly as part of standard construction. The pump conductor shall be the length required to properly connect the pump and panel, but in no case shall be less than forty (40) feet.

C. Each pump shall be provided with a guiderail assembly designed so that each pump automatically connects to the discharge piping when the pump is lowered into place. Lowering of the pump shall be accomplished by simple linear downward motion of

the pump with the entire weight of the pump guided by two (2)-inch guide rails of schedule 40 stainless steel construction. Each pump casing shall have a sealing flange to mate with the discharge connectors provided with the bottom of each guide rail assembly. Discharge connection shall be bolted to the sump floor and shall mate and seal with the pump flange without the immediate installation of any bolts or nuts. When lowered into place, no rotary motion of the pump shall be required for sealing with the discharge connection. The pump shall be easily removable for inspection and/or service and there shall be no need for personnel to enter the pump wet well for purposes of removing the pump. All hardware, lifting assemblies and guide bars shall be stainless steel.

D. Pumps shall have a tandem mechanical shaft seal system, mechanical seals shall be made of tungsten-carbide or silicon-carbide with a stainless steel case. Wearing rings shall be abrasion resistant and shall be installed at the inlet side of the pump to provide protection against wear to the impeller. Pump and motor shaft is to be a one-piece stainless steel shaft (AISI, Type 420) the lower bearing is to be a double row or two single rows thrust bearing. Volutes and impellers shall have no parts that have to be periodically adjusted to correct tolerances due to normal wear. The lifting handle shall be stainless steel and be large enough to hook the pump with a standard assembly from a height of 20 feet and be equipped with a grip eye lifting cable and tool.

E. The pumps shall be equipped with a moisture sensor to detect seal failures, if required by the pump manufacturer for warranty purposes. A visual signal with a manual override shall be used at the control panel.

F. Pump motor shall be housed in an air-filled watertight casing and shall have Class F insulated windings which shall be moisture resistant. The motor shall be Nema Design B rated 155^{o} C maximum and have a minimum 1.15 service factor. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially, or nonsubmerged condition. The pump shall be capable of running dry continuously in a totally dry condition. Cable junction box and motor shall be separated by a stator-lead sealing gland or terminal board which shall isolate motor from any water or solids gaining access through pump cable.

G. Pump level controls shall be multi-level controllers, in lieu of float type switches. Multi-level controllers shall include PLC, preassembled and prewired in the pump control panel and shall be programmed by the pump manufacturer's representative at time of pump start-up.

2.6 CONTROLS

A. Control Panel Manufacturer

1. The panel manufacturer shall be experienced in the construction of lift station control panels, shall have a UL approved shop, and shall be able to provide

both a UL 508 label for the panel, itself and a UL label for the service rated.

2. The panel manufacturer shall warrant the panel for one (1) full year minimum from the date of start-up.

3. The panel manufacturer or qualified technical representative shall check-out and test the panel as part of the lift station start-up with SLCU and Engineer of Record.

B. Panel Components

1. The panel components are specified in the Construction Standard and Contract documents. All panel components may not be specifically specified, however that does not relieve the Contractor from furnishing such components that would normally and customarily be required for wastewater pumping stations.

C. Enclosure

1. The panel itself shall be 30 inch wide by 36 inch high by 10 inches deep (30"W x 36"H x 10"D) for motors 7 1/2 h.p. or less; and 36 inch wide x 48 inch high by 12 inch deep (36"W x 48"W x 12"D) for motors larger than 7 1/2 h.p. The panel shall be of a NEMA 4X construction with the following features:

   a. Constructed of 304 stainless steel 14 gauge with a #3 polish on the exterior.

   b. All external hardware shall be stainless steel with piano hinge, three-point latch with roller fitting top and bottom and single handle with padlock fitting and stainless steel external parts.

   b. Drip shield to deflect water from the door, closed cell neoprene gasket on the door.

   d. Blank outer door with dead front inner door of 1/8" thick aluminum hinged on the left with the operator's controls mounted on or projecting through it.

   e. Stainless steel back mounting plate for heavy components.

   f. Aluminum enclosure, 1/8 inch thick around the surge arrestor and surge capacitor with a 1/8 inch minimum lexan cover which will cover the ends of the arrestor and capacitor and the incoming line terminals. The object is to isolate the lightning arrestor and surge capacitor in case of failure and provide protection for the operator

from the live terminals if the breaker is open.

g. The outer door is to have a nine inch by eleven inch (9" x 11") stainless steel pocket for log book, tack weld to door.

h. Arms and latches shall hold both outer door and inner door in an open position, these must be sufficiently rigid and secure to hold doors open under windy weather conditions.

i. Sliding locking bar to allow only main or emergency breaker to be closed. Bar shall be aluminum with stainless steel hardware.

j. All hardware shall be 316 stainless steel.

D. Wiring

1. All wiring shall be copper THWN or approved equal, AWG 14 minimum. Color code wires as follows:

Controls		
Ground	-	Green
Grounded Neutral	-	White
120 Volt Power	-	Black
Control	-	Red
24 Volt Control	-	Blue

Power	230/240Y/120	480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

Different control wiring colors are acceptable if clearly identified. Power wiring shall be kept separate from control wiring, and shall be identified by phase. The high leg shall be the center terminal on the main breaker.

2. All wires shall be numbered with machine made plastic wrap around labels at both ends.

3. All external connection and internal connections, where shown on the drawings, shall be brought to the numbered terminals.

4. Wiring shall be enclosed in panduct or equivalent wireways and wiring between the doors and the panel shall be enclosed in a spiral wrap or approved equal with sufficient slack to allow full opening of the door.

5. Wiring shall be secured with screw-on tabs, tabs with adhesives shall not be used.

6. All wiring shall be front accessible.

7. All conduit to be U.V. Resistant PVC Schedule 80 listed for electrical use.

E. Component Mounting

1. All components shall be securely mounted with stainless steel hardware. Self tapping screws are not acceptable.

2. All relay bases shall be front mounted with screw terminals, no soldered connections shall be used. All base terminals shall be numbered to correspond to relay numbers. Where plug-in components are not firmly secured in bases, hold down clamps shall be provided.

F. Identification

1. All components shall be identified in accordance with the schematic diagram, using permanent nametags on the panel of laminated micarta or approved equal. The permanent nametags shall be securely attached and in a position where they are clearly visible.

2. All operators' controls shall be provided with laminated micarta nametags attached with stainless steel screws, with minimum lettering height of 1/8 inch.

3. Provide a laminated as-built schematic drawing attached to the inside of the outer door - minimum size 11 inches by 17 inches (11" x 17").

4. Attach a separate laminated label showing the following details:

	PUMP		MOTOR
a.	Brand	a.	Horsepower
b.	Catalog number	b.	Speed
c.	Impeller number and size	c.	Voltage
d.	Design head	d.	Full load amps
e.	G.P.M.	e.	Catalog number
f.	Serial numbers	f.	Serial numbers

G. Component Features

1. Main and Emergency Breaker: The panel shall include circuit breaker sized as required for main power and emergency power disconnect. Breakers shall be mounted on the subpanel with handles through inner door and shall include a mechanical interlock on the handles to insure that only one breaker can be in the "ON" position at any one time. Circuit breaker ampacity voltage and interrupting capacity shall be listed on the Drawings. Panel shall also include an externally mounted generator power receptacle pre-wired to the emergency breaker.

2. High Level Alarm System: The panel shall include a vapor-proof red light mounted on the top of the enclosure for high level alarm visual indication and a weatherproof horn mounted on the underside of the panel box. The alarm light and horn shall be pre-wired to terminals to operate on a high-level control signal. An alarm silence push button labeled "Alarm Silence" shall be mounted on the outside of the enclosure and pre-wired to a relay which will silence the horn under all conditions, and automatically reset when high level condition is corrected. The high level light shall have a flasher to pulse the red external visual indicator light during a high level condition. Alarm system to automatically reset when the high level condition is corrected. The alarm light is to be designed and positioned to provide an unobstructed access for changing light bulb.

3. Elapsed Time Meters: The panel shall include a non-resettable type elapsed time meter for each starter mounted on the inner door to record the accumulated running time of each pump. A totalizer to record running time of all pumps shall also be provided.

4. Convenience Receptacle: The panel shall have a GFI (ground fault interrupter) type convenience receptacle mounted on the inner door to provide plug-in 120V power with ground fault protection. A circuit breaker sufficiently sized shall be provided with the convenience receptacle.

5. Phase and Voltage Monitor Relay: The panel shall have a line voltage rated phase sequence and loss monitor relay. The monitor relay shall be the adjustable type to be field set for nominal available incoming voltage. The monitor relay will be pre-wired to take the control circuit out of service if a phase is reversed, one or more phases are lost, or drops below nominal voltage or if all three phases drop below nominal voltage. The unit will automatically restore when normal conditions are restored; phase monitor by-pass switch shall be required. Relay shall be the socket mounted type.

6. Seal Failure Indicator: The panel shall have a seal failure (leak detector) indicator pilot light for each pump. These pilot lights shall be operated by moisture sensing monitors which are signaled by probes supplied in each

pump.

7. Lightning Arrester/Surge Suppressor: The panel shall have three-phase transient voltage lightning arrester/surge suppressor protection. The suppressors shall be pre-wired to the point of incoming line service. The suppressor shall be Atlantic Scientific or approved equal with voltage as required.

8. Level Control Circuit: The panel shall contain the necessary relays and PLC for the multi level type level switch/controller system; i.e., off-lead-lag-alarm. The level controller shall be the "probe stick" capacitance type controller in lieu of the mercury float type pump control. The panel shall have level indicator mounted on the inner door to indicate the level of liquid within the wetwell via the probe stick. The operating levels of the pumps as well as the alarms shall be settable from the controller.

9. Hand-Off-Automatic (HOA) control switches shall provide means to operate each pump manually on automatically. When operated in the automatic mode, the control component shall provide means to automatically alternate the position of the "Lead" and "Lag" pumps after each pumping cycle. Operation of the pumps in the manual mode shall bypass all control circuits except pump motor overload shutdown.

10. Provide separate circuit breakers for each motor.

11. Provide a spare contact for each alarm. These contacts shall be terminated on a terminal strip for future use.

12. Future Telemetry system: The components shall include, but not be limited to, terminal strip, relays, level switches, power supply (24 volt and 120 volt) and pilot lights.

13. An open frame, across-the-line, NEMA rated, magnetic motor contactors with 120 volt, 60 Hz coils shall be furnished for each pump motor. Contacts and coil shall be easily replaceable without removing the contactor from its mounted position.

14. HOA switches shall be NEMA 4 watertight units. Indicator lamps shall be mounted in NEMA 4 modules. Lamps shall be easily replaceable from the front of the control compartment door without removing the lamp module from its mounted position.

H. Main Power Disconnect

1. Shall included a circuit breaker sized as required for disconnecting main power to panel box and will be housed in separate enclosure mounted behind

main panel box. Where required by the power company, an additional disconnect will be provided prior to the meter.

PART 3 -- EXECUTION

3.1 LIFT STATION INSTALLATION

A. Installation of the wet well, valve pit and piping shall be in accordance with the specifications set forth in other applicable sections of these Specifications.

B. All installations shall be performed in such a manner so that components are plumb and true and aligned in such a manner that the station is fully operable and functional and no additional maintenance or restorative action is required. All electrical installations shall be performed by a licensed Electrical Contractor in accordance with prevailing codes and licensing requirements and shall result in a fully functioning station meeting the full intent of these specifications and the drawings.

C. The Contractor shall install the required fence in a true and straight manner, construct the required water service with RPZ backflow preventor, construct the paved driveway access, construct all necessary conduit and electrical connections and all other appurtenances shown on the standard SLCU Details, the Contract Drawings or reflected within these specifications to provide for a fully functional installation.

D. Particular attention should be given to the following items by the Contractor during installation of the lift station.

1. Reaction plates and restraining rods must be secured to eliminate vibrations that may crack grout.

2. All guiderails shall be attached to access lid frame with approved bracket assemblies. Intermediate guiderail supports shall be provided per manufacturer's recommendations. Guiderails shall be stainless steel piping.

3. Lifting rings for the wet well or valve vault shall be removed below the surface and grouted flush to avoid tripping hazards.

4. Concrete work to be of a professional quality with nonskid finish.

5. All discharge elbows shall be level and plumb to ensure all guiderails will work properly and that pumps can be removed easily and seat properly.

6. All adapter flanges shall be installed according to drawings to allow easy removal of valves. All bolts shall be torqued according to the manufacturer's recommendations.

E. The lift station site, within the fenced area shall be laid with 2 ply 40 visqueen and 3/4 inch rock, no less than 6" deep, or 6” thick concrete.

F. Modifications to the existing pumping stations shall be completed in accordance with these specifications and the details shown on the Standard SLCU Details and the Contract Drawings. This includes all work materials, and cleaning to provide a fully operational station in a “Like-new” condition.

3.2 INSPECTIONS

A. Inspections shall be coordinated with the Engineer of Record, SLCU, Contractor and Contractor's manufacturers representative for the station. The following items shall be the basis of acceptance:

1. The pumps are reasonably pumping on the design curve(s).

2. The design amperage is not being exceeded.

3. The station is functioning as designed.

4. The station was built in accordance with these standards.

5. The pumps shall be pulled to the surface and put on the ground, then reinstalled on the guide rails and lowered in place by the manufacturer’s representative prior to testing of the pumps.

3.3 START-UP

A. The Engineer of Record and SLCU shall be notified 48 hours prior to start-up of the lift station. During start-up the Contractors manufacturer's representative shall be present at the job site. The manufacturer's representative shall be responsible for delivery of the following:

1. Three (3) parts manuals.

2. Three (3) station/pump operation and maintenance (O/M) manuals.

3. Three (3) complete set of electrical schematics.

4. Three (3) start-up reports including all start-up parameters tested and their results and a pump performance certification signed by the representative certifying the pumps meet the specifications and are ready for operation by others. The pumps shall be tested in the presence of the Engineer of Record and a SLCU Representative at a minimum of three (3) points on the curve including the design and shutoff heads. Certified test results shall be provided upon completion of the testing. Failure to meet the specified pump

requirements will result in replacement and re-testing of the pump at the contractor's expense.

5. Backflow assemblies shall be certified complete by a technician certified to do so.

3.4 WARRANTY

A. Pumps shall have a minimum 5 year warranty covering 100% of all parts and labor for the first year and 50% of all parts and labor the remaining 4 years. The warranty period shall commence at the time of pump station acceptance by SLCU.

3.5 SERVICE

A. Pump suppliers shall have adequate repair/service facilities and parts inventory to ensure timely and efficient repair of all equipment supplied. The pump supplier shall provide a reference list of existing installations upon request.

*** * END OF SECTION * ***